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"Sustainability in the Livestock Sector: Environmental Gain and Economic Viability"

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Chairman Costa, Ranking Member Johnson and Members of the Subcommittee, thank you for inviting me to speak to you today. I am Kim Stackhouse-Lawson, Director of AgNext and a Professor of Animal Sciences at Colorado State University. AgNext at Colorado State University is a leader for research in animal and ecosystem health while enhancing profitability of the supply chain and serves as the crossroads for producers, industry partners, and researchers to come together to innovate real-time solutions for sustainability in animal agriculture. Our research focuses on advancing the science of animal agriculture to ensure a continued safe, secure, and nutritious food supply. Our mission is to identify and scale innovation that fosters the health of animals and ecosystems to promote profitable industries that support vibrant communities.

Prior to leading AgNext, I served as the Director of Sustainability for JBS USA where I was responsible for coordinating the company's corporate sustainability program and strategy. In this role, I served as the Chair of the U.S. Roundtable for Sustainable Beef. Prior to my time with JBS USA, I was the Executive Director of Global Sustainability at the National Cattlemen's Beef Association where I developed the beef checkoff sustainability research program and the U.S. Roundtable for Sustainable Beef. I believe strongly in engaging with the value chain and demonstrate this commitment through active leadership that fosters strong private-public partnerships.

Livestock Agriculture is a Complex System

Due to the complexity and importance of animal agriculture systems, we must consider interactions and potential unintended consequences of solutions towards enhanced sustainability. Sustainability may be best described as a "wicked" problem as no definitive formulation of the problem exists. It does not have one solution and stakeholders often have different frames of reference or perspectives (Kebreab, 2013). An integrated science-based approach is necessary when assessing sustainability, where multiple aspects of the system should be considered to understand the tradeoffs when the system is altered. For example, those solutions developed to reduce greenhouse gas emissions, should only be implemented if they do not sacrifice (and ideally improve) different ecosystem elements. Those elements include, but is not limited to, land, air, and water quality, water use, food security, animal health and well-being, worker safety and satisfaction, impacts on public health, racial and gender equality, and value chain profitability. We must consider unintended consequences and trade-offs as we start to explore sustainability in livestock systems.

Sustainability Defined

Sustainability is a term used across many industries and it has increased in interest and research over the last 20 years. However, the complex nature of sustainability and its varying interpretations makes a definitive definition elusive. In the broadest of terms, it can be defined as meeting the needs of the society today, without compromising the ability of future generations to meet their needs (EPA, 2021). However, over the past decade the most cited definitions of sustainability have advanced to include the three pillars: social, economic and environmental. Each pillar is dependent on the other and no one pillar is more important. The overlap between the pillars (socio-economic, eco-environmental, and socio-environmental) are equally critical to

prioritize because it is within these complexities that systems must function (see Figure 1). Further complicating this topic is the importance that an individual places on the different aspects of sustainability, which adds an emotional element. Generally, sustainability includes aspiration focused on continuous improvement across all aspects; however, measuring and tracking that progress is challenging due to the complex nature of the topic itself.

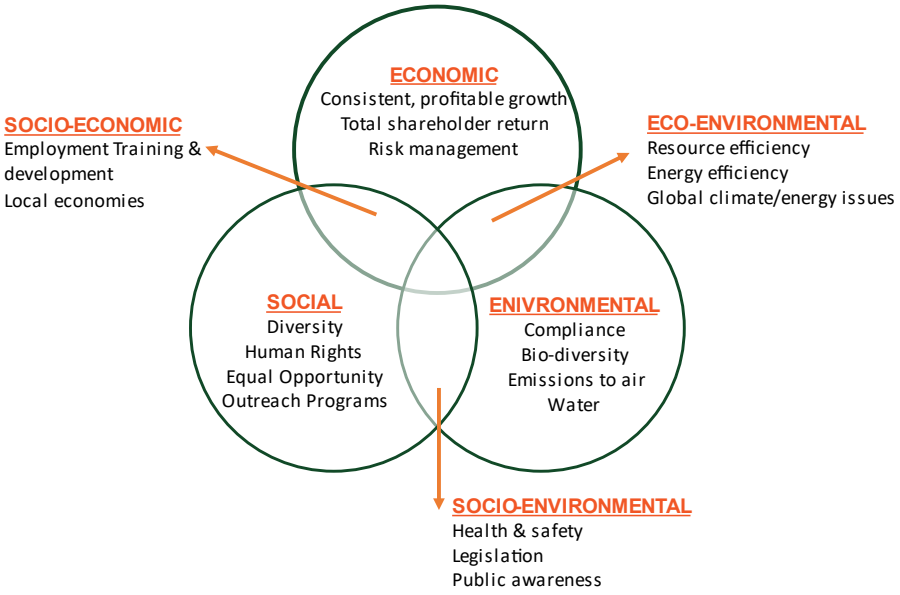

Figure 1: Schematic detailing the complexities of sustainability, please note this does not include an exhaustive list of metrics.

Further complicating this area of study, is the pace at which the space of sustainability is growing in importance. Many leading companies and industries have announced aggressive sustainability goals, including NetZero targets (defined as climate or carbon neutral) that will have real and lasting impacts on food systems as we know them today. Many of these commitments are directly in line with the recommendations released in the 6th assessment report from International Panel on Climate Change which suggests a crucial need to focus specifically on reducing global temperature through greenhouse gas (GHG) reduction. Additional research will be critical for the livestock industry to make progress toward GHG reductions.

Livestock's Contribution to Food System Resiliency and Food Security

In food production, sustainability is generally described alongside our need to feed a growing population. By 2050, our planet's population will increase by 2.2 billion requiring food production to increase by 70%. Estimates suggest that animal agriculture production will need to increase 100% to ensure adequate nutrition to this rapidly growing population. There is no question that this will be the greatest challenge of our lifetime. Providing this nutrition and doing so within the bounds of our planetary resources in an equitable way should be our focus.

The livestock production system in the U.S. is based largely on family-owned ranches that produce beef, dairy and lamb. These livestock operations are a critical element of the affordable,

high-quality protein food production systems for domestic and international consumers. Particularly in the highly variable arid and semi-arid climates of the United States, the ability of ruminant livestock to convert non-human consumable forage to human-edible food on lands unsuitable for crop production presents an opportunity for sustainable intensification, while achieving multiple social-ecological objectives (Booker et al. 2013, Sayre et al. 2017).

Ranching-based livestock systems are the dominant land use in much of the North American Great Plains. These ecosystems have experienced less conversion to cropland compared to the wetter, more mesic systems of the eastern part (Augustine 2019) and represents largely intact native ecosystems still exist in western ecoregions. These ecosystems are suited to both livestock production and provision of multiple ecosystem services, including biodiversity and habitat connectivity, carbon sequestration, grassland bird habitat, and cultural services such as open space, tourism opportunities, and recreation.

Livestock food production is an essential food system; however, it is often criticized for its environmental impact, especially its impact on climate change. The critical nature and timeliness of ensuring food security and doubling food production while also meeting GHG emission reductions is no small task. We need to focus on solutions that also consider the social, environmental and economic tradeoffs and the impact that extreme decisions could have on the system as a whole. In sustainability, silver bullets do not exist, we must take a more inclusive a systematic approach to ensure we do not solve one problem and create three more.

GHG Impact from Livestock Systems

The livestock accounts for 3.8% of U.S. greenhouse gas emissions and enteric methane accounts for approximately 30% of methane emissions in the U.S. (EPA, 2021). To curb continued increases in temperature, President Biden has committed to Net Zero emissions in the U.S. by 2050 and a reduction in methane emissions by 30% by 2030 relative to a 2020 baseline. Additionally, numerous food companies in the animal agriculture supply-chain have committed to NetZero emissions by 2040 or 2050 and there is further pressure from financial institutions and investors to demonstrate improved performance related to GHG emissions. However, minimal research on emissions from cattle has occurred in production environments or exploring the additive effect of current technologies, thereby necessitating a first step of baselining emissions of livestock in a production environment.

Over the past several decades, large improvements in production efficiency and land utilization have occurred in the livestock industry. This has been driven by innovations in feeding management and diet formulation, improvements in animal health and welfare, animal genetics and utilization of feed additives. Relative to 1977 production practices, cattle production produced 81% of the manure, 82% of the methane, and 88% of the nitrous oxide, all while producing more human edible protein with less animals (Capper, 2010). While sustainability has become a major focus recently, it is critical to acknowledge that this livestock industry has been dedicated to continuous improvement for several decades and has already set audacious net zero emission goals across multiple livestock sectors.

Livestock systems are incredibly diverse. There is tremendous variability across industries from dairies to ranches to feedyards and differences within each industry. Practices that are implemented on livestock operations in one region will vary greatly from another because of the resources available and climatic differences. For example, dairies in Pennsylvania are different than in Colorado. A ranch in Florida is distinctly different than a ranch in Idaho. Sustainable solutions for mitigating environmental impact will vary greatly based on the location, size and scale of the livestock operation. It is critical that the U.S. conducts research across multiple segments of the supply chain and across geographical regional differences so that we can develop solutions that are practical for the region, practical for farmers and ranchers to adopt, and applicable to that operation.

There is a significant gap in this research, especially related to livestock's contribution to climate change. Greenhouse gases from livestock are difficult to measure, and until the last decade scientists did not have a non-invasive method to quantify enteric methane emissions in production environments. This means that models utilized to quantify emissions were not developed from animals behaving normally and in normal environments. Furthermore, quantifying other important greenhouse gases related to livestock (ie. nitrous oxide) is extremely expensive and difficult due to the impact the weather conditions and topography can have on the ability to quantify these emissions. Filling this knowledge gap will allow both the livestock industry and climate scientists to have a better understanding of how food production interacts with the environment by improving the current models.

Economic Impacts from Livestock Systems

Livestock producers, feeders and processors also play a critical role in the U.S. economy and support rural economies. A successful agriculture sector supports economic growth overall while also providing a safe and nutritious food supply. An additional component of this research must focus on scalable solutions that are also profitable for producers to promote economic growth, while ensuring that the food system can produce the amount of nutrient dense food that will be required to meet the nutritional needs of a growing population over the coming decades. As we move toward researching sustainable solutions for the livestock industry it is critical that any solutions generated are economically viable and scalable across a wide range of operations.

Sustainable Solutions in Livestock Systems

The livestock industry and academic community are actively exploring how to effectively measure, validate and continually improve its overall sustainability in a holistic and comprehensive way. This is not easy as a one size fits all approach which is not applicable to biological systems like food production. Currently, there is limited access to federal funding, grants, and private investments to research sustainability and greenhouse gas emissions in livestock systems. The equipment needed to conduct this critical research is available, but in order to gain access to this cutting-edge technology more funding will be required to begin to thoroughly understand the baseline of GHG emissions from livestock systems.

Without a robust understanding of baseline emissions, producers and others along the supply chain are faced with the challenge to reduce emissions, but without an understanding of where to

begin, which makes it is nearly impossible to understand if mitigation strategies are effective. Pressure is being placed on producers to mitigate impact and they are being asked to adapt and reduce emissions without the appropriate tools that they need move as quickly as they are being asked to. It is imperative that solutions that are generated are scalable, economically feasible and practical for producers to utilize to encourage high adoption rates.

For enteric methane emissions, a high priority area is to establish baseline emissions and develop practical solutions for producers in grazing systems. These systems are the largest contributor to the footprint of the beef industry but most research on enteric methane reduction strategies occur in controlled feedlot environments and diets. This will require investment in research as emissions and production systems exist as gradient in grazing systems. Forage types, local weather/climate, and individual producer management decisions all influence the emissions from grazing animals.

Developing affordable methods in quantifying nitrogen loss to the environment is a crucial need for food production systems. While we understand how weather events influence nitrogen deposition, we need to improve methods for quantification of nitrous oxide emissions, ammonia emissions, and nitrogen leaching. The development of interventions that reduce nitrogen losses and improve nitrogen use efficiency has the potential to improve the sustainability of both livestock and cropping systems.

Today there is considerable interest in utilizing grazing systems to sequester carbon in the soil to offset emissions from the food supply chain. This includes various carbon markets being developed to incentivize producers to manage their landscapes in a way that improves carbon sequestration and soil health. While the literature does indicate this is possible, arid environments do not appear to have capacity to increase soil carbon stocks due to a lack of moisture. Furthermore, how grazing management influences soil carbon and soil health is very inconsistent. More work is needed to come to a scientific consensus on appropriate grazing management across different climatic gradients.

Often lost in the discussion of sustainable livestock systems is the suite of other ecosystem services that producers offer for society as stewards of the land. This includes culture and leisure, energy, water quality, managing for wildlife habitat, fuel reduction, and biodiversity. Investment in research that quantifies these benefits and offers economic returns to producers can help them improve the sustainability of their operations while providing benefits to greater society.

Climate change is going to have a major impact on our food supply chain. Currently, we expect to see positive changes such an increased growing season and increased forage production. However, we also expect increased climate variability, including the frequency of extreme weather events such as drought and flooding. These changes alone are going to challenge, and require improvements, in the adaptive capacity and resiliency of our producers and rural communities. With further market and political variability, producers need investment from public and private sources to improve their ability to navigate future challenges while continuing to provide a safe and nutrient dense food supply.

Public investing in the space of sustainability is rapidly increasing and evolving faster than ever before. This has led to companies across a multitude of industries, including agriculture, committing to a net-zero future. In his 2022 letter to CEO's, Blackrock CEO and President Larry Fink said "Every company and every industry will be transformed by the transition to a net zero world.... all markets will require unprecedented investment in decarbonization technology. We need transformative discoveries on a level with the electric light bulb, and we need to foster investment in them so that they are scalable and affordable. To develop a truly sustainable solutions all stakeholders need to be engaged and invested in the process, and this includes government entities and policy makers.

Thank you for the opportunity to testify before this panel. I would be glad to address your questions and I look forward to the discussion.

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